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10/579,928	05/19/2006	**Bahaa Eddine Sarroukh**	NL 031379	3682

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EXAMINER	
ALBERTALLI, BRIAN LOUIS	

ART UNIT	PAPER NUMBER
2626	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/579,928	SARROUKH ET AL.	
	Examiner	Art Unit	
	BRIAN L. ALBERTALLI	2626	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2. Claim 13 is rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claim 13 is directed to "A computer program product comprising respective code..." However, the specification defines a "computer program product" as including wireless network connections and program listings on paper which are nonstatutory. Wireless network connections are non-statutory because a signal, as a form of energy, does not fall within one of the four statutory categories of invention. A listing of program code on paper is non-statutory because a statutory computer readable medium is *encoded* with a computer program to create a *computer element* which defines structural and functional interrelationships between the computer program and the rest of the computer to allow the programs functionality to be realized. A mere listing of computer code on paper is not a computer element which would define structural and functional interrelationships between the computer program and the rest of the computer.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Initially, it should be noted that, in general, incorporation by reference to specific figures in the claims is discouraged unless there is no practical way to define the invention in words (see MPEP 2173.05(s)). Furthermore, the incorporation by reference in the instant claims render the claims indefinite. It cannot be determined whether the incorporated references are intended to limit the claim or not. For example, claim 1 recites "input audio signals (u1, u2, u3)" and "an array of respective microphones (101, 103, 105)". It is unclear whether the claimed "input audio signals" or "array of microphones" includes a plurality (i.e. two or more) audio signals or microphones, or whether the input audio signals and array of microphones is limited to three audio signals and three microphones.

Independent claim 12 includes similar limitations and is rejected for the reasons given above.

Thus, claims 1-13 fail to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

For the purposes of examination, it has been assumed that the incorporated references were not intended to be limiting. Therefore, for example, the claimed "input audio signals" has been interpreted as including two or more audio signals.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1, 2, 7, and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hoshuyama (U.S. Patent 6,449,586), in view of Belt et al. (U.S. Patent Application Publication 2002/0013695).

In regard to claim 1, Hoshuyama discloses a beamformer (Fig. 17, note Fig. 17 is a combination of a first embodiment shown in Fig. 1 and a third embodiment shown in Fig. 10, see column 19, line 61 to column 20, line 8), comprising:

a filtered sum beamformer arranged to process input audio signals from an array of respective microphones (fixed beamformer 2 receiving input from microphones 1*m*, column 1, lines 56-67), and arranged to yield as an output a first audio signal predominantly corresponding to sound from a desired audio source (target signals are enhanced and interference signals are attenuated at the output of fixed beamformer 3, column 2, lines 23-37); and

a scaling factor determining unit (step size control circuit 51), arranged to provide a scale factor evaluated as a first function of a ratio of a first variable being an estimate of the non-noise corrupted audio signal originating from the desired sound source present in the first audio signal and a second variable being an estimate of the noise

present in the first audio signal (the step size control circuit is switched depending upon a ratio of the target signal and the interference signal, column 12, lines 36-46),

wherein adaptive filters are arranged to scale the adaptation step size with the scale factor (adaptive filters are updated according to the determined adaptation step size, column 12, lines 47-53).

While Hoshuyama discloses adaptive filters associated with a blocking matrix are adapted according to the determined adaptation step size (adaptive filters 5*m*, see column 15, lines 54-59), Hoshuyama does not disclose the beamformer is adaptive in the sense that the input audio signals are filtered with a first set of respective adaptable filters which are susceptible to be changed by adding to at least one coefficient a difference value, obtained as a function of an adaptation step size.

Belt et al. disclose an adaptive beamformer comprising a set of adaptable filters wherein the first set of respective adaptable filters are susceptible to be changed by adding to at least one coefficient a difference value, obtained as a function of an adaptation step size (a filtered sum beamformer is continuously subjected to adaptations of the filtering coefficients based on an adaptation step size, paragraphs 0022-0023).

It would have been obvious to one of ordinary skill in the art at the time of invention to replace the fixed beamformer of Hoshuyama with the adaptive beamformer of Belt et al. so that the adaptation step size of Belt et al. was dependent on the step size control unit of Hoshuyama, because adaptive beamformers allow the filtering

characteristics to adapt based on the input signals, thus providing better localization of a desired sound source.

In regard to claim 2, Hoshuyama discloses a sidelobe canceller (Fig. 17) comprising:

an adaptive noise estimator arranged to derive an estimated noise signal by filtering respective noise measurements derived from the input audio signals with a second set of adaptable filters (a multi-input canceller includes an adaptive filter group 7*m* for providing output to subtractor 9, column 4, lines 5-24); and

a subtractor connected to subtract the estimated noise signal form the first audio signal to obtain a noise cleaned audio signal (the subtractor subtracts the output of the multi-input canceller from the output of the beamformer to produce a noise cleaned output signal by attenuating any interference signals, column 4, lines 25-32 and column 5, lines 35-38).

In regard to claim 7, Hoshuyama discloses applying a binary decision function to the ratio and adapting set of filters only if the decision is 1 (see Fig. 8, a comparator in the step size control circuit is set to zero when the output of the beamformer is greater than the output of the blocking matrix and set to 1 otherwise, column 14, lines 33-57).

In regard to claim 12, Hoshuyama discloses a method of adaptive beamforming, comprising:

beamforming filtering input audio signals from an array of respective microphones (fixed beamformer 2 receiving input from microphones 1*m*, column 1, lines 56-67) with a first set of beamforming filters yielding a first audio signal predominantly corresponding to sound from a desired audio source (target signals are enhanced and interference signals are attenuated at the output of fixed beamformer 3, column 2, lines 23-37);

determining a scale factor evaluated as a first function of a ratio of a first variable being an estimate of the non-noise corrupted audio signal originating from the desired sound source present in the first audio signal and a second variable being an estimate of the noise present in the first audio signal (the step size control circuit is switched depending upon a ratio of the target signal and the interference signal, column 12, lines 36-46), and

scaling an adaptation step size with a scale factor (adaptive filters are updated according to the determined adaptation step size, column 12, lines 47-53).

While Hoshuyama discloses adaptive filters associated with a blocking matrix are adapted according to the determined adaptation step size (adaptive filters 5*m*, see column 15, lines 54-59), Hoshuyama does not disclose the beamforming filtering is adaptive in the sense that the coefficients of a first set of adaptable filters in the beamforming are changeable by adding to at least one coefficient a difference value obtained as a function of an adaptation step size.

Belt et al. disclose adaptive beamform filtering wherein a first set of respective adaptable filters are susceptible to be changed by adding to at least one coefficient a

difference value, obtained as a function of an adaptation step size (a filtered sum beamformer is continuously subjected to adaptations of the filtering coefficients based on an adaptation step size, paragraphs 0022-0023).

It would have been obvious to one of ordinary skill in the art at the time of invention to replace the fixed beamforming of Hoshuyama with the adaptive beamforming of Belt et al. so that the adaptation step size of Belt et al. was dependent on the step size control unit of Hoshuyama, because adaptive beamforming allows the filtering characteristics to adapt based on the input signals, thus providing better localization of a desired sound source.

7. Claims 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hoshuyama, in view of Belt et al., and further in view of Brandstein et al. (U.S. Patent 5,737,431).

In regard to claim 8, Hoshuyama and Belt et al. do not disclose any specific applications of the beamforming devices.

Brandstein et al. disclose a handsfree speech communications device comprising an adaptive beamformer (handsfree speech acquisition through a teleconferencing device, column 1, lines 49-56).

It would have been obvious to one of ordinary skill in the art at the time of invention to utilize the adaptive beamformer of Hoshuyama and Belt et al. in a handsfree speech communications device, because beamforming provides an

advantageous technique for picking up speech in handsfree teleconferencing applications, as suggested by Brandstein et al. (column 1, lines 49-56).

In regard to claims 9 and 10, Hoshuyama and Belt et al. do not disclose any specific applications of the beamforming devices.

Brandstein et al. disclose a consumer apparatus comprising a voice control unit comprising an adaptive beamformer (handsfree speech acquisition through a teleconferencing device, column 1, lines 49-56).

It would have been obvious to one of ordinary skill in the art at the time of invention to utilize the adaptive beamformer of Hoshuyama and Belt et al. in a consumer apparatus comprising a voice control unit, because beamforming provides an advantageous technique for use in voice controlled consumer devices such as teleconferencing devices, as suggested by Brandstein et al. (column 1, lines 49-56).

In regard to claim 11, Hoshuyama and Belt et al. do not disclose any specific applications of the beamforming devices.

Brandstein et al. disclose a tracking device arranged for tracking an audio producing object, comprising an adaptive beamformer (a beamformer tracks the location of speakers to follow a moving talker, column 1, line 49-65).

It would have been obvious to one of ordinary skill in the art at the time of invention to utilize the adaptive beamformer of Hoshuyama and Belt et al. in a tracking device arranged for tracking an audio producing object, because beamforming provides

an advantageous technique for following and picking up the speech of a moving talker, as suggested by Brandstein et al. (column 1, lines 49-56).

8. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hoshuyama, in view of Belt et al., and further in view of Marash et al. (U.S. Patent 6,363,345).

In regard to claim 13, Hoshuyama and Belt et al. do not disclose a computer program product comprising respective code for enabling a processor to execute each of the steps of the method of claim 12.

Marash et al. disclose a computer program product comprising respective code for enabling a processor to execute a beamforming method (a software application embedded on a computer-readable medium, column 9, lines 6-12).

It would have been obvious to one of ordinary skill in the art at the time of invention to implement the method taught by Hoshuyama and Belt et al. a computer program product comprising respective code for enabling a processor to execute the steps of the method, because, as is well known to those of ordinary skill in the art at the time of invention, a computer program product comprising code defines structural and functional interrelationships between the computer program and other claimed elements of a computer, which permit the computer program's functionality to be realized.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Zangi (U.S. Patent 7,099,822) disclose an adaptive beamformer with a voice activity detector that updates noise filters during noise only periods. Rutkowski et al. (*Identification and Tracking of Active Speaker's Position in Noisy Environments*) disclose a beamforming technique using an adaptive step size. Hoshuyama et al. *(A Robust Adaptive Beamformer for Microphone Arrays with a Blocking Matrix Using Constrained Adaptive Filters*) disclose a adaptation constraint for beamforming filters. Hoshuyama et al. (*A Realtime Robust Adaptive Microphone Array Controlled by an SNR Estimate*) disclose a method for updating adaptive beamforming filters based on a signal to noise ratio estimate. Oh et al. (U.S. Patent 5,353,376) and Krasney et al. (U.S. Patent 6,937,980) disclose additional adaptive beamformers.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to BRIAN L. ALBERTALLI whose telephone number is (571)272-7616. The examiner can normally be reached on Monday-Thursday, 8 AM to 6:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Hudspeth can be reached on (571) 272-7843. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

BLA 4/30/09
/Brian L Albertalli/
Examiner, Art Unit 2626